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ABSTRACT

The Biglan model, a theoretical framework for empirically examining the differences among subject areas, classifies according to three dimensions: adherence to common set of paradigms (hard or soft), application orientation (pure or applied), and emphasis on living systems (life or nonlife). Tests of the model are reviewed, and a further test is applied that addresses a noted deficiency in the model: its applicability to postsecondary education institutions other than research or doctorate-granting schools, specifically the comprehensive colleges. In the latter study, almost 9,000 faculty in 158 institutions were surveyed; equal proportions of respondents represented each of the five major institution types in the Carnegie classification. Response rate was 51.7 percent. The survey consisted of 128 questions coded into 781 variables. The study used the respondents' primary fields of research, scholarship, and creativity as the dependent variable. The results indicate that the model can be generalized to the comprehensive colleges and research-doctoral institutions in a limited way. Of the three dimensions in the model, differences were found only between the hard-soft groups on both types of campuses. The research-oriented variables contributing to this difference are the number of journal articles vs. the number of books or monographs produced by the faculty members, and may be explained more by the faculty's prior research training than by institutional affiliation. Several limitations are noted: (1) independent variables other than those used in the study may discriminate between Biglan groups; (2) the small number of respondents used in each cell was relatively small; and (3) this test used the "augmented" model composed of 78 departments, yet relatively untested. Future research is recommended into the model's use with institutional types. A list of references, a table of Biglan model tests, and tables of variables and results are appended. (MSE)

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Biglan Model Test
Based on Institutional Diversity

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A Biglan Model Test Based on Institutional Diversity

The examination of significant similarities and differences among disciplines in postsecondary education institutions has been a subject of study by sociologists of science for several years (Hagstrom, 1965; Kuhn, 1970; Merton, 1963). As Storer (1972) contends, much of the research may stem from Robert Merton's work on the priorities of scientific discovery (1957) in which he advanced the central thesis that the need for professional recognition motivates faculty to engage in scientific research. From Merton's general thesis has emerged several lines of inquiry, including the analysis of important ways in which scientific disciplines differ from one another. Specifically, these differences have been studied in terms of the organization of knowledge and the social context of research using shorthand labels such as "hard," "soft," "pure," and "applied." (Storer, 1967; Feibleman, 1972; Amick, 1973). Despite this growing body of literature, Storer (1972) recommends that a need still exists for a comprehensive theoretical framework for exploring the differences among subject matter areas in postsecondary education institutions.

The Biglan model presents one theoretical framework that can be used to empirically examine the differences among subject areas. The model was developed in 1971 by Anthony Biglan, then a social-psychologist working on a study of department chairs at the University of Illinois (Biglan, 1971; Biglan, Oncken & Fielder, 1971). The model classified 35 academic subject areas on the basis of three

dimensions: their adherence to a common set of paradigms, referred to as hard or soft; their application orientation, pure or applied, and the emphasis on living systems, life or nonlife (1973a).[1] In an empirical test of the model, Biglan (1973b) found differences in faculty work between hard and soft, pure and applied, and life and non-life areas. Since this first test of the model, it has been replicated nine times by authors working independently across the country (Smart & Elton, 1975, 1976; Eison, 1976; Hesseldenz & Smith, 1977; McGrath, 1978; Smart & McLaughlin, 1978; Muffo & Langston, 1979; Creswell, Seagren & Henry, 1979; Creswell & Bean, forthcoming). Since numerous tests of the model have now been made, the first purpose of this study will be to review the Biglan model studies.

The second purpose of this study will be to provide another test of the model that addresses a deficiency in the studies to date. This deficiency has been pointed out by authors of two Biglan model studies (Eison, 1976; Muffo & Langston, 1979), namely, whether the model is applicable to types of postsecondary education institutions other than research or doctoral granting schools. While the empirical investigations have relied primarily on data from respondents from research-oriented institutions (e.g., Biglan, 1973b; Smart & Elton, 1975, 1976), the applicability of the model

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[1]Biglan (1973a) clarifies his use of the term "paradigm" by referring to Kuhn's (1970) definition that "paradigms" are those generalizations, definitions, values, beliefs in a particular model, and solutions to problems shared by a community of specialists in postsecondary education institutions.

for other types of institutions such as the comprehensive state colleges has remained untested. Thus, to extend the research on the model, this study will determine whether the Biglan classification can be generalized to both the research-doctoral granting institutions and the comprehensive colleges. Specifically, do the independent variables used in this study discriminate between the hard-soft, pure-applied, and life-nonlife areas of the Biglan model on both types of college campuses? If they discriminate on one type, but not on both types, then one can infer that the type of institution may be an important mediating factor in explaining the differences between the groups in the model and institutional characteristics must be taken into consideration in the tests and the applications of the model.

Studies About the Biglan Model

Biglan's three dimensions were derived from the data he gathered from faculty at the University of Illinois and at one small liberal arts college in the State of Washington. He asked the faculty from these institutions to categorize 35 academic departments into groups based on similar characteristics of the subject matter of each area (Biglan, 1973a). Using Kruskal's (1964) technique for nonmetric multidimensional scaling, he grouped each department into three dimensions. He attributed the differences among subject areas to three factors: the extent to which the areas had a well-defined paradigm structure; the extent to which they had an orientation to application; and the extent to which they were oriented to living organisms. After categorizing 35 academic departments into hard or soft, pure or applied, and life

or nonlife areas, Biglan arranged these departments into a three-dimensional model, resulting in eight categores (HNP = hard-non-life-pure; SNP = soft-nonlife-pure; SLP = soft-life-pure; HNA = hard-nonlife-applied; HLA = hard-life-applied; SNA = soft-nonlife-applied; SLA = soft-life-applied).

Biglan (1973b) immediately tested his model and reported the results in the Journal of Applied Psychology. The results of his test demonstrated differences between the hard-soft, pure-applied, and life-nonlife areas using variables related to collaboration with colleagues, preferences of faculty for teaching or research, and scholarly output (e.g., journal articles, books, monographs). Within two years of Biglan's validation study, other authors began to test the model using different measures.

The tests of the model, including Biglan's 1973 study, are shown in Table 1. Five summary comments can be made about these

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tests including some thoughts about inherent weaknesses in them. First, as can be seen in Table 1, the model has been used to test a wide array of measures. Although one might question whether the differences found between Biglan groups in these studies are an artifact of the measures being used, surprisingly consistent results have occurred using diverse samples and different measures. These consistent results portray differences between the hard-soft and the pure-applied areas in most studies, and differences between the life-nonlife areas in a few studies.

Second, implicit in all of the studies (and even in the use of the model) is the assumption that only three dimensions underlie the differences among subject areas. Perhaps more than three exist, and in the Biglan model study by McGrath (1978), he suggests the possibility of redefining the life-nonlife dimension into four or more variables such as social, biological, human, and animate characteristics. Besides this redefinition, McGrath also recommends other ways in which subject areas may be characterized: creative, empirical, exact/inexact, abstract/concrete, service/nonservice, physical/nonphysical, prestige, interest, and optimism/pessimism.

Third, the authors of the Biglan model tests reported their results in terms of differences between only two groups at a time (e.g., hard vs. soft) rather than in terms of the interactive effects of all groups. For example, distinctive features of the hard-pure groups versus the soft-applied groups may be found worthy of future analysis.

Fourth, various conceptual explanations have been advanced by the authors. In general, two schools of thought are apparent. The first is based on the argument about the structure of knowledge and is drawn from Kuhn (1970) and is used by Biglan (1973b). Kuhn (1970) argues that academic fields (and the faculty who work in the fields) differ because of their stage of technological development. Some subject areas are in the pre-paradigmatic stage (e.g., political science) where the field has few or no guidelines for research; conversely, others are in the paradigmatic stage (e.g., chemistry) where the contents and methods of research are clearly understood. The second school of thought is drawn from the

social-psychology literature of role theory (Sarbin, 1968) and socialization (Brim & Wheeler, 1966). This argument, used by Smart and Elton (1976), suggests that faculty and chairs in academic areas act differently because they adopt the role of members of the areas, first as graduate students and then as junior members of the faculty.

While both schools of thought may explain some of the differences that emerge in the empirical studies of the three Biglan dimensions, a perceptive distinction made by Storer (1967, 1972) may impact the thinking in this area. Storer makes the general point that the rationale for differences between the hard and soft groups differs from the rationale between the pure and applied groups: the first dimension is concerned with the intellectual meaning of the discipline; the second dimension is concerned with the social or organizational aspect of subject areas. One examining the hard-soft dimension, for example, might look at the existence of theoretical bodies of knowledge; while one probing the pure-applied dimension might examine the reward structures.

Fifth, several authors have mentioned the important role of institutional types in the generalization of the model from one campus to another. Muffo and Langston (1979) argued against the generalization and suggested that the best results of tests were found when data from the University of Illinois were used, where Biglan first tested the model. On the other hand, Eison (1976), who studied faculty in only one university, strongly suggested testing the model in different types of postsecondary education institutions.

In a test where the same independent measures are used for respondents from the research-doctoral granting institutions and the comprehensive colleges to determine if differences exist among the Biglan groups, three possible outcomes can occur. The first possibility is that differences may be established between the hard-soft, pure-applied, and life-nonlife groups at both the research-doctoral granting institutions and the comprehensive colleges. In this case, one could assume that the model could be generalized to both types of institutions. Second, differences could be found between the Biglan groups at the comprehensive colleges but not at the research-doctoral granting institutions. While this possibility certainly exists, it is unlikely to occur because differences have been established between the groups at research-doctoral granting institutions in other tests of the model, and one of these tests (Creswell & Bean, forthcoming) even used the Ladd-Lipset (1978) data base, the same data base used in the present study.

The third possibility is for the differences to be found at the research-doctoral granting institutions, but not on the comprehensive college campuses. In this case, the model would not be generalizable and future tests should be conducted only using data from research-doctoral granting institutions. Such results might be explained by the institutional emphasis and reward system on the comprehensive college campuses. Althought faculty within comprehensive colleges differ in their subject matter orientation, the institutional emphasis on good teaching may mask the differences that are present in subject matter areas. Rather than take different positions on teaching and curriculum issues or conduct

different forms of research, the faculty in all subject areas in the comprehensive college may conform to homogeneous values and research output in response to the institutional reward system.

Method

The data used in this study came from the 1977 Survey of the American Professoriate, a national study of faculty attitudes and opinions conducted by Ladd and Lipset (1978).[2] Approximately nine thousand (8,697) faculty at 158 institutions were sent copies of the survey so that equal proportions of respondents represented each of the five major types of institutions in the Carnegie classification (The Carnegie Commission on Higher Education, 1973); 4,383 (51.7%) of the usable responses were returned. As discussed in the technical report, steps were taken to insure that the data were representative, reliable, and valid.

The entire survey consisted of 128 questions coded into 781 variables. Of this item pool, this study used: one variable to select out the two samples for study; nine independent variables; and one dependent variable (see Appendix A). Since this study focused on two major categories of institutions (i.e., comprehensive colleges and research-doctoral granting institutions), the authors used the nine-tier Carnegie classification variable to select out respondents for analysis from these two types of institutions. The independent variables in the analyses

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[2]The technical report of the survey, available from the Roper Center at the University of Connecticut, provides detailed information about the data base.

were grouped into two areas: research output, and teaching and curriculum measures. The five research-oriented variables were used by Creswell and Bean (forthcoming) to examine the differences among the Biglan model groups based on research output measures. Since data from respondents in research-doctoral granting institutions were being analyzed, the authors felt that research-oriented independent variables would best discriminate between the Biglan groups. A similar rationale was used to select the teaching-oriented variables, since comprehensive colleges generally have a strong teaching orientation.

This study used the respondents' primary fields of research, scholarship, and creativity as the dependent variable in the study. This item in the Ladd and Lipset (1978) survey asked respondents to check one of eighty subject areas as their primary field. Other items asked respondents to indicate their schools, divisions, or departments where their principal appointments were held, and to indicate their present principal teaching fields. Since the correlations between principal appointment area, teaching field, and research, scholarship, and creativity were quite high (r=.70-.90), the authors decided to use only the primary field of research, scholarship, and creativity as the dependent variable.

A problem with the Biglan model identified in earlier research (e.g., Muffo and Langston, 1979; Creswell and Roskens, forthcoming) is that only 35 subject areas are categorized into the eight cells of the model. This deficiency was overcome in this study by the

application of a recently developed "augmented" Biglan model by Drees (unpublished paper).[3] Employing the Ladd-Lipset (1978) data base, Drees classified the ungrouped subject areas

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in the list of 76 using the classification procedure of multiple discriminate analysis. His procedure relied on a sorting technique wherein each subject area was classified as either hard or soft, pure or applied, or life or nonlife based on discriminant functions. In this way, all 76 subject areas were categorized into the model and the number of cases for each cell was substantially increased in the discriminant analyses.

A major objective of discriminant analysis is to classify objects by a set of independent variables into one or more mutually exclusive and exhaustive categories (Morrison, 1969). One or more linear combinations of discriminating variables, called functions, are used to maximize the discriminant criterion (Tatsuoka, 1971). Coefficients on this function indicate which variables contribute to the greatest differences among the groups under study and which rank highest in importance in making this distinction. Thus, one

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[3]The details of this "augumentation" procedure can be obtained by writing L. Drees, Regents Hall, The University of Nebraska, Lincoln, Nebraska, 68588.

is able to discriminate between groups on the basis of some set of characteristics, determine how well they discriminate, and identify which characteristics are the most powerful discriminators (Klecka, 1980).

In addition to calculating the discriminant functions, the authors also plotted the group means (centroids) for each of the eight Biglan groups. These centroids were plotted in a two-dimensional space to demonstrate visually the distinctiveness of each group. Only those discriminate functions significant at $p \leq .01$ were plotted.

The authors conducted two separate disciminant analyses: one for the comprehensive college respondents; and one for the research-doctoral granting institution respondents. To create equal numbers of cases in each cell of the model for discriminant analysis, a weighting procedure was used, resulting in an n of 48 for each cell for the comprehensive college analysis and 365 for each cell in the research-doctoral granting institution analysis.

Results

The two discriminant analyses will be described separately and followed by some statements comparing the major findings of both analyses. For the comprehensive college respondents, the direct method of entering all independent variables resulted in six of the nine having significant univariate F-rations at $p \leq .05$ (see Table 3). Three significant functions at $p \leq .01$ also accounted for approximately 88% of the cumulative variance (see Table 4).

Table 4 presents the standardized discriminant coefficients for

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each of the three functions. The coefficients underlined for each function are used to "describe" the positive and negative axes in the discriminant space of a graphic plot of the eight Biglan groups, as shown in Figure 1. In Table 4, two teaching-oriented variables (i.e., expand the core curriculum and rigorous grading system) best "describe" the function which contributes

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the most discrimination to the eight Biglan groups for the comprehensive college respondents. However, the second function also adds considerably to the variance (30.64%) and this function is "described" by research-related independent variables.

When the two functions are plotted as shown in Figure 1, the Biglan group centroids displayed a hard-soft division for function II. On this function, three of the hard area group centroids were plotted on the positive side of the vertical axis, and the fourth (HLA) on the line (i.e., horizontal axis) between the positive and negative sides of the vertical axis. Conversely, three of the soft area group centroids were found on the negative side of the vertical axis and the fourth, on the line (SNP). Thus, an interpretation of this result is that the faculty in the hard

area groups have published more total journal articles than the soft area groups; whereas, the soft area groups have published more books and monographs.

In plots not displayed here of other combinations of functions, the centroids of the Biglan groups did not meaningfully cluster according to hard-soft, pure-applied, life-nonlife divisions with the exception of the plot for functions I and III. On function III, the horizontal axis divided the nonlife Biglan groups from the life-oriented groups. The nonlife-oriented groups (e.g., HNP) published more journal articles in the last two years and the life-oriented groups wanted to expand the core curriculum more than the nonlife groups. However, since function III only added 12% of the variance to the discrimination, the significance of this life-nonlife difference must be interpreted with caution.

Turning to the discriminant analysis for the respondents from the research-doctoral granting institutions, the direct method of entering the independent variables resulted in all nine having significant univariate F-ratios at $p \leq .01$ (see Table 3). Four significant functions at $p \leq .01$ emerged and accounted for 98% of the cumulative variance (see Table 5.) Table 5 also displays

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the standardized discriminant coefficients for each of the four significant functions. The underlined coefficients of the independent variables once again "describe" the functions.

Functions I and II, which account for 89% of the cumulative variance, are "described" by research-oriented independent variables, (i.e., number of books and articles published and degree of interest in research). While the third and fourth functions relate to teaching-oriented independent variables, the two functions account for only 10% of the total cumulative variance. Thus, the most important discriminating variables for the eight Biglan groups based on data from the research-doctoral granting institutions are research-oriented measures.

The plots for the centroids of the eight Biglan groups, as shown in Figure 2 supports a distinction between the hard and soft

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areas in terms of the length of scholarly communication in publications. All four of the hard area groups were found on the negative side of the horizontal axis and all soft area groups, on the positive side. This means that faculty in the hard area groups publish in shorter-length works such as journals; whereas, soft area faculty publish in longer forms of communication such as books and monographs.

In other graphs (not displayed here), all combinations of functions were plotted to determine if the other two dimensions (i.e., pure-applied and life-nonlife) could be distinguished by the clustering of the groups. These dimensions did not emerge; thus, the independent variables for the respondents from the research-doctoral granting institutions only distinguished between the hard and soft Biglan groups.

In summary, the two discriminant analyses resulted in several significant findings. First, the independent variables that best discriminate between the Biglan groups are different for the comprehensive college respondents than the research-doctoral granting institution respondents. Teaching and curriculum-related variables best discriminate for the comprehensive college respondents and research-oriented variables for the research-doctoral granting institution respondents. Second, only the hard-soft dimension of the model was replicated at both types of institutions. Except in the one instance of the life-nonlife division for the comprehensive college faculty, the Biglan groups did not cluster according to the pure or applied and life or nonlife areas in the graphic plots. Third, the research-oriented variables such as the number of articles and the number of books and monographs distinguished between the hard and soft groups for respondents from both types of institutions. Based on these three major results of the data analysis, the research problem posed at the beginning of this paper can now be answered.

Discussion

Earlier the research problem was posed as to whether the Biglan model could be generalized across institutional types. Specifically, do the independent variables in this study discriminate between the hard and soft, pure and applied, and life and nonlife groups of faculty respondents both on the comprehensive college campuses and at the research-doctoral granting institutions?

The results of this test indicate that the model can be generalized to the comprehensive colleges and the research-

doctoral granting institutions in a limited way. Of the three dimensions in the model, differences were found only between the hard-soft groups on both types of campuses and no differences were found between the pure and applied and life and nonlife groups. Also, the research-oriented independent variables best discriminated between the hard-soft groups on both campuses; while, the teaching-oriented independent variables did not differentiate between the hard-soft, pure-applied, and life-nonlife groups on either type of campus.

In light of these findings, some tentative explanations for these results can be advanced. Since the hard-soft dimension was replicated on both types of campuses, it may be helpful to closely examine the research-oriented variables that contributed to the differences-- number of journal articles vs. number of books or monographs. Both variables represent a form of scholarly communication and can be distinguished in terms of their length of communication. This variability in the communication of research has been discussed by other authors writing about the hard-soft dimension of the Biglan model (Biglan, 1973b; Creswell and Bean, forthcoming) and in an earlier work by Hagstrom (1965). The length of a scholarly communication may be a result of years of graduate training wherein the students learn the patterns of publication in the discipline. When these students are later placed in faculty positions, they may publish in either journal - or book-length works, irrespective of the type of institution wherein they are employed. Thus, whether the faculty publish in a shorter-length work (e.g., journal) or a longer one (e.g., book)

may be more a function of their prior research training than their institutional affiliation and explain the result of the hard-soft differences occurring on both types of campuses.

The independent variables did not discriminate between the pure and applied areas and life and nonlife areas as might be expected from these differences being established in other studies of the Biglan model (e.g., Smart and Elton, 1975, 1976). One explanation could be based on the limited number of independent variables in the discriminant analysis; using other discriminators, differences might be found. An alternative explanation is that the pure-applied and life-nonlife dimensions may not be generalizable features of subject areas on different campuses. As Storer (1972) suggests, the pure-applied dimension may be more a characteristic of individuals working in a subject than of the subject matter structure itself. Since the work environment for individuals may vary from institution to institution, one would not expect to generalize the pure-applied dimension across institutional types.

Certain limitations should be noted as one interprets the results of this study. Already one limitation has been implied: independent variables other than those used in this study may discriminate between the Biglan groups. Further, because of the small number of total comprehensive college respondents used in the discriminant analysis, the number of cases in each of the eight Biglan cells was relatively small (n=48) for parametric analysis. Finally, this test of the Biglan model used the "augmented" model composed of 78 departments. At this stage of research about the

model, the "augumented" classification scheme remains untested, except for the one test reported here and further tests of this "augmented" procedure should be made.

Despite these limitations, future research about the model should continue to explore the importance of institutional types. This test reported on the applicability of the model for two types of institutions in the Carnegie typology: the comprehensive colleges and the research-doctoral granting institutions. Unfortunately, the number of respondents from the liberal arts colleges and the 2-year institutions was too small in the Ladd-Lipset (1978) data base for multivariate analysis. Certainly, the generalizability of the model using tested independent variables should be examined using other types of institutions than those reported here.

In a larger sense, those who write about the differences among disciplines in postsecondary education institutions now have available a conceptual model, the Biglan model, for examining those distinctions. Attempts to replicate the model have been successful; however, its applicability to different types of institutions may be limited to only the hard-soft dimension of the model. Despite the numerous tests of the model and its applicability, an understanding of the differences among academic areas is still in embryonic form: the tests must continue until generalizations can be developed to adequately predict clear distinctions among disciplines. With the Biglan model, the work on discipline-orientations, initiated by the sociologists of science, has entered a new phase-that phase being the testing of an empirical model of differences among academic areas.

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Table 1
Tests of the Biglan Model

Studies	Subjects	Variables Related to the Model	Results	Conceptual Frameworks/Explanations
Biglan (1973b)	Faculty and Department heads in 47 departments at the University of Illinois. (N=620)	Social connectedness, commitment of scholars, and scholarly output.	Differences found between hard-life, pure-applied, and life-nonlife areas.	Menzel's (1962) studies of technical information provided by colleagues in physical sciences. Kuhn's suggestions about socialization of scholars to paradigms.
Smart and Elton (1975)	Department chairmen in 32 state-supported universities. (N=1646)	Eleven departmental goals.	Differences found between hard-soft, pure-applied, and life-nonlife areas.	None stated.
Smart and Elton (1976)	Department chairmen in 32 state-supported universities. (N=1646)	Twenty-seven duties performed by department chairmen.	Differences found between hard-soft, pure-applied, and life-nonlife areas.	Sarbin's (1968) concept of anticipatory socialization; Brim's (1960) role theory; Light's (1974) styles of work.
Eison (1976)	Faculty at Western Kentucky University. (N=276)	Job satisfaction as measured by the Job Description Index (JDI) - 5 indices.	Two dimensions may exist: pure vs. applied and life vs. nonlife.	None stated.
Hesseldenz and Smith (1977)	Doctoral graduates from the University of Kentucky (N=869)	Response rates to a mailed computer prepared and offset-printed questionnaires.	Differences found between the hard-soft subject areas.	Origin of the questionnaire from a soft discipline and use of a semantic differential scale, a soft survey technique.

Table 1 (continued)

Smart and McLaughlin (1978)	Faculty in a large land/grant university. (N=1320)	Eleven categories of professional responsibilities, years of service, total years of professional experience in higher education, salary of each faculty member.	With salary as criterion variable, differences found between hard-soft and pure-applied.	Three dimensions are imbedded in three reinforcement patterns (reward structures) of a large university.
McGrath (1978)	Undergraduate and graduate students at University of Southwestern Lousiana. (N=unknown)	Total number of books charged from the circulation desk.	Differences found between hard-soft and pure-applied groups	Merton (1963) and Storer's (1972) contention that pure/applied is less a characteristic of the subject matter than of the individuals working on the subject.
Muffo and Langston (1979)	Faculty in 30 departments at the University of Illinois. (N=1104)	Five variables measuring faculty activities and the A.C.E. Disciplinary ratings.	Hard-soft, pure-applied, life-nonlife dimensions had significantly different salaries for three faculty ranks.	None stated.
Creswell, Seagren and Henry (1979)	Department chairs at one major university and four state colleges. (N=120)	Perceived need for professional development on fourteen chair tasks.	Department chairs had different professional development needs when grouped into hard or soft, pure or applied, life or nonlife categories.	Sarbin's (1968) concept of socialization, Light's (1974) differer styles of work, Hersey and Blanchard's (1972) leadership styles.
Creswell and Bean (in press)	Ladd and Lipset Survey of the American Professoriate. (N=2274)	Research productivity variables.	Differences found between the hard-soft, pure-applied and life-nonlife areas.	Brim and Wheeler's (1966) anticipatory socialization, Kuhn's (1970) paradigmatic stage of technological development.

Table 2

CLUSTERING OF 76 LADD-LIPSET ACADEMIC TASK AREAS
IN THE "AUGMENTED" MODEL

Pure, Hard, Nonlife	Pure, Hard, Life	Pure, Soft, Nonlife	Pure, Soft, Life
Mathematics and Statistics	Molecular & Cellular Biology	English Language & Literature	Psychology
Astronomy	Microbiology	Foreign Language & Literature	Anthropology & Archaeology
Chemistry	Physiology	History	Political Science, Government
Environmental Sciences	Other Biological Sciences	Philosophy	Sociology
Physics	Virology	Other Humanities Fields	Behavior Schiences
Biological Sciences	Biochemistry, Biophysics*	Law	Geography*
Anatomy*	Developmental, Genetics	Library Science	Public Health
Medicine	Immunology*		Physical Sciences (General)*
Other Physical Sciences	Organismic Biology*		Social Sciences (General)*
	Systematics, Evolution*		Other Social Sciences
	Ecology		
	Health Sciences, Clinical		
	Health Sciences, Basic		

Applied, Hard Nonlife	Applied, Hard, Life	Applied, Soft, Nonlife	Applied, Soft, Life
Computer Science	Agriculture and/or Forestry	Accounting	Education
Civil Engineering	Chemical Engineering	Finance	Vocational-Technical Training
Mechanical Engineering	Pharmacy	Economics	Architecture and/or Design
Other Engineering Fields	Optometry*	Business Administration (General)	Food Science & Technology*
Engineering (General)		Marketing	Secretarial Studies*
Aeronautical and Astronautical*		Management	Fine Arts (General)*
Electrical Engineering		Other Business Fields	Art
Denistry		Veterinary Science	Dramatics and Speech
Allied Health		Industrial Arts*	Music
			Other Fine Arts
			Nursing
			Home Economics
			Journalism
			Physical & Health Education
			Social Work, Social Welfare

Notes: Underscored academic areas were selected from Ladd-Lipset areas as being those which most closely corresponded to Biglan's original 35 areas.

*Academic areas with an asterisk are those which the discriminant function could not group and an arbitrary decision was made.

Table 3

GROUP MEANS, STANDARD DEVIATIONS AND UNIVARIATE F-RATIO

	Biglan Groups																Univariate F-Ratio
	HLP		HNP		HLA		HNA		SLP		SNP		SLA		SNA		
	X	SD	X	SD	X	SD	X	SD	X	SD	X	SD	X	SD	X	SD	
Students Underprepared																	
Comp. Colleges	1.53	.62	1.50	.63	1.50	.51	1.71	.55	1.43	.59	1.41	.52	1.61	.54	1.35	.50	2.10*
Research & Doct. Inst.	1.64	.66	1.72	.65	1.68	.56	1.62	.66	1.73	.64	1.61	.67	1.69	.61	1.62	.64	2.02*
Grade Inflation Problem																	
Comp. Colleges	1.47	.50	1.55	.55	1.5	.51	1.33	.57	1.57	.63	1.[illegible]7	.49	1.59	.64	1.49	.58	1.29
Research & Doct. Inst.	1.68	.64	1.64	.64	1.75	.61	1.66	.68	1.57	.60	1.59	.63	1.59	.63	1.59	.65	3.36**
Expand Core Curriculum																	
Comp. Colleges	2.00	.83	1.64	.73	2.50	.51	1.86	.84	1.90	.82	1.54	.74	2.04	.83	2.03	.78	6.97***
Research & Doct. Inst.	1.88	.76	1.98	.78	1.91	.77	2.03	.79	1.90	.76	1.60	.71	2.05	.76	2.02	.80	12.99***
Rigorous Grading System																	
Comp. Colleges	1.63	.61	1.43	.55	1.00	0.0	1.33	.48	1.86	.72	1.58	.60	1.93	.67	1.54	.56	13.23***
Research & Doct. Inst.	1.58	.60	1.53	.58	1.55	.59	1.51	.62	1.70	.66	1.61	.61	1.82	.65	1.52	.59	10.89***
Number of books published																	
Comp. Colleges	1.40	.62	1.79	1.11	1.00	0.0	1.52	.92	1.57	.80	1.70	.97	1.63	.94	1.58	.90	3.89***
Research & Doct. Inst.	1.65	.96	1.63	.88	1.63	.99	1.64	.97	2.20	1.14	2.20	1.13	1.89	1.10	2.26	1.16	27.77***
Number of Articles Published																	
Comp. Colleges	4.37	1.74	3.38	2.00	2.00	1.01	2.95	1.48	2.48	1.47	3.03	1.69	2.33	1.45	2.59	1.35	10.87***
Research & Doct. Inst.	5.96	1.79	5.60	1.88	5.05	2.22	4.61	1.98	4.56	1.79	3.80	1.74	3.18	1.86	3.97	1.86	88.44***
Number of Books-last 2 yrs.																	
Comp. Colleges	1.17	.53	1.29	.71	1.00	0.0	1.05	.22	1.17	.44	1.32	.72	1.17	.45	1.32	1.03	1.98
Research & Doct. Inst.	1.30	.71	1.26	.69	1.28	.59	1.28	.74	1.62	.91	1.50	.74	1.36	.91	1.56	.94	11.98***
Number of Articles-last 2 yrs.																	
Comp. Colleges	2.50	1.78	3.02	2.32	1.50	.51	2.24	1.52	2.24	1.59	2.46	1.55	2.03	1.71	2.33	1.74	3.27**
Research & Doct. Inst.	5.03	2.34	4.59	2.38	4.49	2.43	3.82	2.25	3.93	2.12	2.98	1.82	2.53	1.83	3.37	2.16	55.88***
Interest-Research or Teaching																	
Comp. Colleges	2.93	.82	2.93	.97	3.00	1.01	3.14	.65	2.83	.91	3.01	.82	3.25	.81	3.22	.72	1.52
Research & Doct. Inst.	1.95	.78	2.28	.86	2.34	.84	2.66	.87	2.23	.80	2.66	.76	3.04	.83	2.62	.84	61.48***

* p≤.05 ** p≤.01 *** p≤.001

Table 4

COMPREHENSIVE COLLEGES

CANONICAL DISCRIMINANT FUNCTIONS AND STANDARDIZED COEFFICIENTS
(N=384)

Function	Eigen-valve	Cumulative Percent of Variance	Canonical Correlation	Wilks' Lambda	Significance
1	.401	45.33	.535	.641	.000
2	.271	75.97	.462	.815	.000
3	.104	87.78	.307	.900	.000

Coefficients

	Function I (Expand Core Curr./ Rigorous Grading)	Function II (Articles/ Articles-Last 2 yrs.)	Function III (Expand Core Curr./ Articles-Last 2 yrs.)
Students Underprepared	-.025	.030	.178
Grade Inflation Problem	.030	.024	-.018
Expand Core Curriculum	-.571	-.176	-.559
Rigorous Grading System	.775	-.321	-.544
Number of Books Published	.283	-.390*	.276
Number of Articles Published	.307	1.270	-.354
Number of Articles-Last 2 years	.069	-.582	.500
Interest-Research on Teaching	.078	.012	-.003

*This coefficient, although the second largest negative coefficient in Function II, is used to "describe" the Function in order to easily compare the results for the comprehensive college respondents with the research-doctoral granting institution respondents.

Table 5

RESEARCH AND DOCTORAL GRANTING INSTITUTIONS

CANONICAL DISCRIMINANT FUNCTIONS AND STANDARDIZED COEFFICIENTS (N=2920)

Function	Eigen-valve	Cumulative Percent of Variance	Canonical Correlation	Wilks' Lambda	Significance
1	.401	73.66	.535	.870	.000
2	.084	89.07	.278	.943	.000
3	.026	93.86	.159	.967	.000
4	.023	98.15	.151	.990	.000

Coefficient

	Function I (Books/ Articles)	Function II (Books/Interest-Research or Teaching	Function III (Grade Inflation/ Expand Core Curr.)	Function IV (Expand Core Curr./ Rigorous Grading)
Students Underprepared	.065	-.048	.253	-.266
Grade Inflation Problem	-.116	.059	-.421	.025
Expand Core Curriculum	.000	.405	.724	.535
Rigorous Grading System	.077	-.105	.450	-.778
Number of Books Published	.594	-.526	-.016	.326
Number of Articles Published	-.834	.177	-.043	-.210
Number of Books-Last 2 years	.163	-.149	.167	.089
Number of Articles-Last 2 years	-.090	.079	.049	.268
Interest-Research or Teaching	.233	.770	-.223	-.004

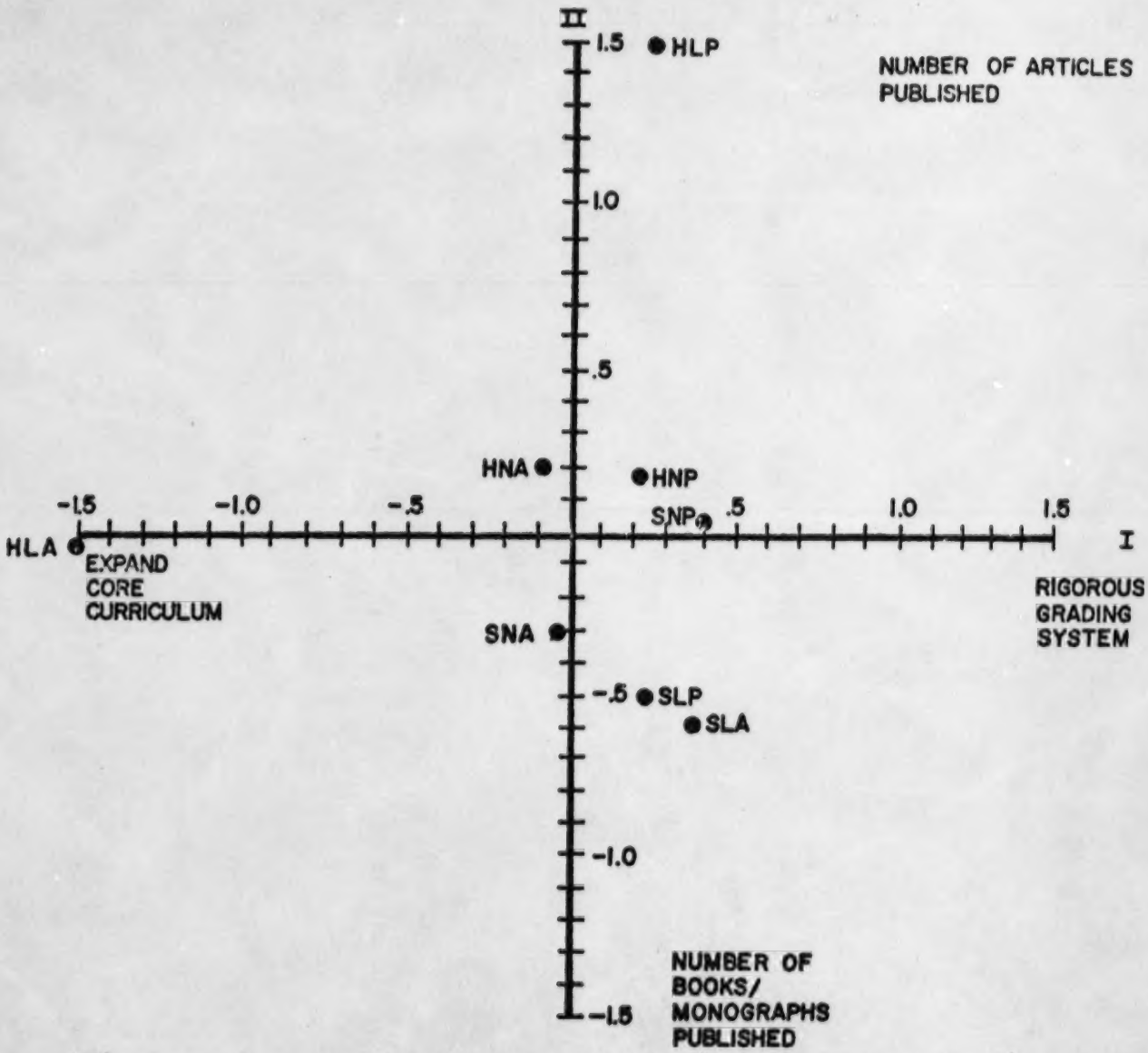

Figure 1. Centroids for Biglan's eight groups of academic areas plotted for Comprehensive Colleges. (SNP=soft-non-life-pure; SPL=soft-life-pure SNA = soft-non-life-applied; SLA=soft-life-applied; HLA = hard-life-applied; HLP = hard-life-pure; HNP=hard-non-life-pure; HNA = hard-nonlife-applied.)

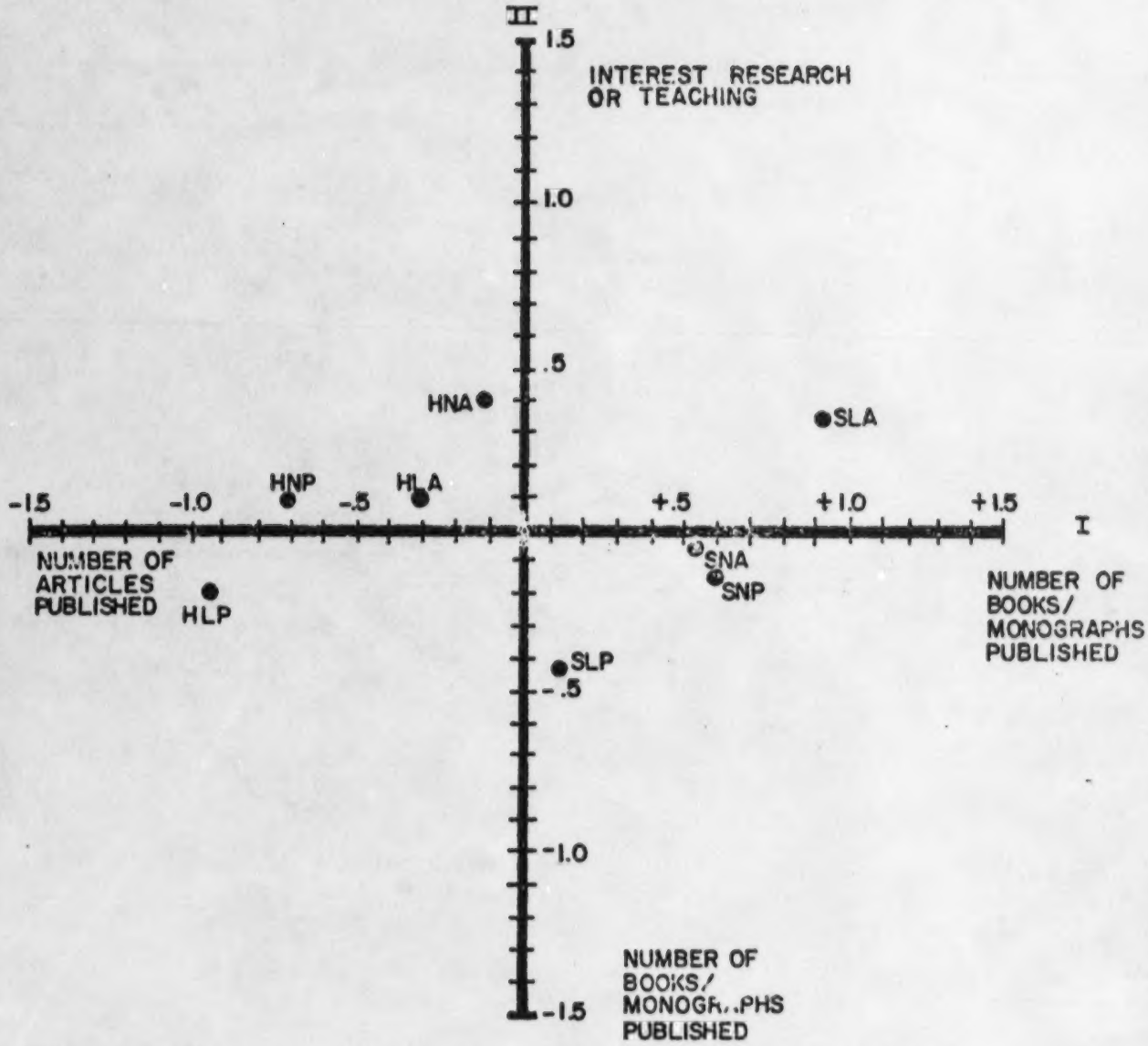

Figure 2. Centroids for Biglan's eight groups of academic areas plotted for Research and Doctoral Granting Institutions. (SNP = soft, non-life-pure; SLP = soft-life-pure; SNA = soft - nonlife-applied; SLA = soft-life- applied; HLA = hard-life- applied; HLP = hard-life-pure; HNP = hard-nonlife-pure; HNA = hard-nonlife-applied.)

Appendix A

Variables in the Study

Independent Variable	Item in Questionnaire	Scale
Students Underprepared	The students with whom I have close contact are seriously underprepared in basic skills--such as those required for written and oral communication.	1=Def. yes to 3=Def. no
Grade Inflation Problem	"Grade inflation" is a serious academic standards problem at my institution.	1=Def. yes to 3=Def. no
Expand Core Curriculum	American higher education should expand the core curriculum, to increase the number of basic courses required of all undergraduates.	1=Def. yes to 3=Def. no
Rigorous Grading System	A grading system which rigorously discriminates good student performance from bad contributes positively to student motivation.	1=Def. yes to 3=Def. no
Number of Books or Monographs Published	How many books or monographs have you published or edited, alone or in collaboration?	1=None to 5=More than 10
Number of Articles in Professional or Academic Journals	How many articles have you published in academic or professional journals?	1=None to 5=More than 10
Number of Books Published in Last Two Years	How many of your books have been published or accepted for publication in the last two years?	1=None to 7=More than 10
Number of Articles Published in Last Two Years	How many of your articles have been published or accepted for publication in the last two years?	1=None to 7=More than 10
Interests in Research or Teaching	Do your interests lie primarily in research or teaching?	1=Very heavily in research to 4=Very heavily in teaching

Dependent Variable

8 Biglan Groups (See Table 2)	Present primary field of research, scholarship or creativity.	1=HNP 2=HLP 3=SNP 4=SLP 5=HNA 6=HLA 7=SNA 8=SLA

Selected Variable

Carnegie Code	Home institution of the respondent.	1-Research Universities I 2=Research Universities II 3=Doctoral Granting Universities I 4=Doctoral Granting Universities II 5=Comprehensive Colleges and Universities I 6=Comprehensive Colleges and Universities II